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Parenting While Food Insecure:

Links between Adult Food Insecurity, Parenting Aggravation and Children's Behaviors

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Abstract

Parents who experience food insecurity face not only uncertainty in obtaining food, but an invisible emotional burden, one that can potentially influence both their parenting behaviors and ultimately, their children. In our study, we investigated adult food insecurity's link to parents' aggravation and whether that aggravation influenced their children's behaviors. Results**,** based on data from the Early Childhood Longitudinal Survey, Kindergarten Class of 2010-11 using first-difference regression, showed that parents (n=7820) of first graders who became food insecure experienced heightened parenting aggravation (0.525; $p < .01$). Our mediation analysis on a matched sample of food secure (n=1600) and insecure parents (n=470) revealed that adult food insecurity was not directly associated with children's behaviors; rather, it was indirectly related to lowered attentional focus (-0.062; $p<.05$) and inhibitory control (-0.093; $p<.001$) via parenting aggravation. Our findings underscore the importance of parenting aggravation in transmitting the effects of food insecurity on children's behaviors.

keywords: adult food insecurity; parenting aggravation; executive functioning; fixed effects; mediation analysis

In the United States, approximately 6.5 million children were from homes where both children and adults in the home experienced *food insecurity* (U.S. Department of Agriculture, 2018) a phenomenon whereby families face uncertainty in obtaining food due to lack of resources, including the monetary means to acquire nutritionally acceptable and safe foods (National Research Council, 2006; U.S. Department of Agriculture, 2018). For the millions of adults across the United States who experience food insecurity, the daily challenges families confront amidst food insecurity involve more than just a lack of a stable source of nutritious foods. Food insecurity can also take an emotional toll on parents themselves. The inadequacy that parents can feel as they struggle to provide food for their families can further influence their psychological wellbeing, manifesting in heightened parental stress (Dunifon & Kowaleski-Jones, 2003; Huang, Matta Oshima, & Kim, 2010), anxiety (Whitaker, Phillips, & Orzol, 2006) and depression (Bronte-Tinkew, Zaslow, Capps, Horowitz, & McNamara, 2007; Melchior et al., 2009). The negative consequences of food insecurity on parents' wellbeing can, in turn, influence the behaviors of their children thereby placing their behavioral development at risk (Gershoff, Aber, Raver, & Lennon, 2007).

In this current study, we also examine food insecurity's relationship to both parental and children's outcomes. Our work makes several new contributions to the literature. First, although prior research has examined food insecurity at the broader household level, we focus more specifically on adult food insecurity which allows us to more precisely pinpoint food insecurity's effects to an adult in the home. Second, though prior studies have also examined pathways through which food insecurity influences children's problem behaviors (Huang et al., 2010), we investigate an outcome that has received less attention in the food insecurity literature: children's executive functioning (EF), including their inhibitory control and attentional focus in first grade.

Children's EF forms a critical foundation for their cognitive development; thus, understanding how food insecurity influences EF, especially in the early elementary years, is important because significant development occurs in children's EF after age 5 (Best, Miller, & Jones, 2009), a time when children can be especially vulnerable to food insecurity. Finally, in investigating pathways between food insecurity, parents and children, we leveraged a novel matching technique known as Coarsened Exact Matching (CEM) (Iacus, King, & Porro, 2011). Given the infeasibility of randomly assigning adults into food insecurity, we used CEM to create matched groups of food secure and insecure adults who were similar across observable characteristics. Comparing outcomes between the matched groups reduced threats due to selection bias.

Background

Parenting While Food Insecure: Theory and Evidence

Conceptual Foundations. Food insecurity—a lack of access to nutritionally adequate and safe food (National Research Council, 2006)—comprises a broader a set of challenges that families face in meeting life's basic needs (U.S. Department of Health and Human Services, 2004). These challenges, known as material hardship, also include other kinds of struggles facing families, such as their lack of access to affordable housing as well as stable medical care.

Theoretically, the Family Stress Model (FSM) offers one way to conceptualize linkages between food insecurity to parental outcomes to children's behavioral outcomes (Conger, Rueter, & Conger, 2000; Masarik & Conger, 2017). Prior research on how food insecurity shapes children's development has drawn upon the FSM (Huang et al., 2010; Johnson & Markowitz, 2018). Broadly, FSM uses a sequential, pathways approach to conceptualize how economic hardship can negatively influence children's development (Figure 1). The model starts with families who financially struggle to make ends meet. Financial strain then leads families to

further confront additional struggles, known in the FSM as *economic pressures* (Masarik & Conger, 2017). These pressures can include a family's inability to fulfill their basic needs, such as sufficient food and housing. The psychological distress (e.g., parental depression and anxiety) caused by these kinds of economic pressures not only triggers relationship problems between parents, but this distress can also lead to suboptimal parenting practices. Finally, the endpoint of the FSM focuses on children's outcomes. One primary way that children can experience negative outcomes is via a path linking economic struggles and pressures, to parent's psychological distress to compromised parenting practices (Masarik & Conger, 2017).

<<insert Figure 1 here>>

Evidence from the broader material hardship literature also shows that hardships can occur alongside lower incomes to influence parental stress; this stress, in turn, affects investments that parents make in raising their children, such as their time and energy, as well as parenting behaviors, including their warmth and responsiveness (Gershoff et al., 2007). Further, and consistent with FSM, the primary pathway through which material hardship can influence children's socio-emotional competence has been shown to be via parenting behaviors (Gershoff et al., 2007).

Based on the FSM framework, the hardship of food insecurity can be a source of economic pressure for families—for some families, acquiring nutritious foods poses a significant challenge and strain. Food insecurity, as an economic pressure, can then influence parents' psychological functioning as well as their parenting behaviors, which, in turn, can influence their children's behavioral development (Ashiabi & O'Neal, 2008).

Evidence of Food Insecurity's Effects on Parents. Consistent with the FSM, empirical evidence shows that food insecurity can alter parents' psycho-social functioning (Alaimo, Olson,

& Frongillo, 2001; Hamelin, Habicht, & Beaudry, 1999; Jyoti, Frongillo, & Jones, 2005; Slack & Yoo, 2005). Selected empirical evidence from several large-scale quantitative studies document the psychological ramifications of household food insecurity, particularly on female heads of households (Heflin, Siefert, & Williams, 2005; Huang et al., 2010; Wu & Schimmele, 2005). In particular, evidence shows that mothers from food insecure homes experienced depression and psychosis spectrum disorders (Melchior et al., 2009), heightened maternal anxiety and depression (Bronte-Tinkew et al., 2007; Whitaker et al., 2006). Qualitative evidence also reveals that food insecurity can lead to parental irritability and anger (Hamelin et al., 1999).

In addition to negative psychological responses to food insecurity among adults, food insecurity shapes parents' own attitudes towards parenting. Mothers from low-income backgrounds from more severe food insecure homes experienced higher parenting stress levels (Huang et al., 2010), a finding which is also reflected in the work of Slack and Yoo (2005). Further, mothers from food insecure homes viewed their role as parents more negatively, views that were consistent irrespective of whether the mothers were from severe or very severe food insecure households (Powers, 2013). Finally, parents of young toddlers from food insecure homes had lowered positive parenting practices that supported their children's socio-emotional and cognitive development (Bronte-Tinkew et al., 2007).

While the aforementioned literature examines parents' responses to household food insecurity, we know less about how parents respond in the wake of their own food insecurity. Focusing specifically on adult food insecurity versus household food insecurity allows us to more precisely attribute food insecurity's effects to an adult in the home (Hernandez & Jacknowitz, 2009). In contrast, focusing on household food insecurity leads to ambiguity over

who exactly is food insecure in the home (e.g., a parent, a child or the child's siblings) thereby creating uncertainty about the potential source of food insecurity's effects.

Evidence of Parents as A Mechanism Linking Food Insecurity to Children's Behaviors. Consistent with the FSM, several of the aforementioned studies have also investigated how parental responses to food insecurity act as a mechanism linking food insecurity to compromised behavioral outcomes for their children. For instance, the heightened depression and anxiety onset by food insecurity is associated with aggressiveness, anxiety and hyperactivity in 3 year olds (Whitaker et al., 2006). Parental depression and anxiety can diminish mother-child interactions thereby limiting stimulation that is crucial for children's development.

Additionally, parenting stress among low-income parents has been shown to mediate the association between household food insecurity and children's externalizing and internalizing behaviors in children older than 3 years (Huang et al., 2010). Finally, and consistent with findings from Huang et al. (2010), parenting stress, warmth and depression all function to mediate household food insecurity's effect on children's internalizing and externalizing behaviors (Slack & Yoo, 2005).

In addition to parenting as a mechanism linking food insecurity to their children's outcomes, studies have also shown that food insecurity can directly affect children's outcomes. For instance, children from food insecure homes have lower achievement in both math and reading, when compared with students from food secure homes (Alaimo et al., 2001; Jyoti et al., 2005; Winicki & Jemison, 2003). Evidence also suggests that household food insecurity is negatively associated with other developmental outcomes such as children's psychosocial functioning (Murphy et al., 1998), internalizing behaviors (Weinreb et al., 2002) and approaches to learning (Howard, 2011).

However, although the FSM model suggests that stressors, like food insecurity can, impact children's behavioral outcomes (Masarik & Conger, 2017), one set of behavioral outcomes that has received less attention in the food insecurity literature is children's executive functioning, such as their attentional focus and inhibitory control. With the exception of Grineski, Morales, Collins, and Rubio (2018), these outcomes have yet to be fully explored in the extant literature on the food insecurity-child development nexus.

Present Study. In our current study, we examine how adult food insecurity relates to parenting aggravation and whether that aggravation subsequently influences their children's behaviors, including their executive functioning. For purposes of our study, *parenting aggravation* refers to the anxiety, stress and strain that parents can experience when caring for their children (Yu & Singh, 2012). Although prior studies on food insecurity and parents have tended to use the term *parenting stress*, we use the term parenting aggravation given that we leverage the Aggravation in Parenting Scale (Ehrle & Moore, 1999), which is based on a subset of items from the PSI (Parenting Stress Index) (Abidin, 1990). Though we know of no other prior studies on the parenting consequences of food insecurity that have specifically used the Aggravation in Parenting Scale, the concept of parenting aggravation has been examined in studies of parents in immigrant families (Yu & Singh, 2012) and parents of children with disabilities (Schieve et al., 2011).

To guide our study, we posited a set of research questions with corresponding hypotheses:

Research Question 1: How does food insecurity, as experienced by parents, relate to their own levels of parenting aggravation?

Based on the Family Stress Model and prior empirical literature examining household-level food insecurity and parental outcomes, we hypothesized that food insecurity as experienced by parents in the home, positively relates to their own levels of parenting aggravation.

Research Question 2: Does parenting aggravation mediate the relationship between adult food insecurity and children's behavioral outcomes (executive functioning and behavior problems)?

We hypothesized that parenting aggression will partially mediate the relationship between food insecurity and children's behavioral outcomes. We hypothesized a partial mediational relationship because of prior evidence of a direct effect of food insecurity on children's behavioral outcomes (Huang et al., 2010; Slack & Yoo, 2005) as well as the role of additional mechanisms, including parental depression, mediating the effect of food insecurity on children's outcomes (Slack & Yoo, 2005).

Method

Dataset

We used secondary data from the restricted use version of the ECLS-K: 2011, a large-scale, nationally representative sample of approximately 18200 children across the US who entered kindergarten in fall 2010. Children and their parents were tracked over time in several successive waves and we used two waves from the restricted use data file: the spring of kindergarten, and first grade. The dataset was well suited for our analyses given its robust set of measures for both parents and their children, including adult food insecurity, parenting aggravation, children's scores on behavioral assessments, and a rich set of parental and child characteristics.

Research Question 1: Sample, Measures and Analytic Strategy

Sample. For our first research question, we used an analytic sample that included approximately 7,820 (rounded to the nearest 10 per restricted-use guidelines) children and adults. We obtained this sample by excluding those in the main sample of 18,200 who had a zero sampling weight. Sampling weights, included with the ECLS-K dataset and incorporated in this study's analyses, adjust for differential nonresponse to child assessments as well as parent and teacher surveys that were administered to study participants in the spring of kindergarten and first grade. Any children with a missing survey component (e.g., no parental survey data) had a zero weight and, thus, they were not part of the analytic sample. In our analytic sample, parental respondents were primarily the biological mothers of the children (85%) followed by their biological fathers (9%) while the remaining adults were classified as a mother or father figure (2%), a non-parental relative (2%) or a non-relative (<.05%).

Missing Data. Although individuals with zero sampling weights did not contribute to the analysis, missing data was still present among the 7,820 in the analytic sample. Rates of missing data among the study's measures for the analytic sample of 7,820 individuals ranged from 0% to approximately 13%. To handle missing data, we used multiple imputation by chained equations (Royston, 2004) and generated 30 imputed datasets since approximately 30% of the children in the dataset had missing data on one or more variable.

Measures.

Outcome: Parenting aggravation. We used the Aggravation in Parenting Scale that was administered as part of the parent interview when the child was in the spring of kindergarten and first grade. The scale consists of four items. Parents indicated how true, on a 4-point scale (*completely, mostly, somewhat, not at all*), they often felt that: (a) being a parent was harder that they thought, (b) their child did things that really bothered them, (c) they gave up more of their

life to meet their child's needs, and (d) they felt angry with their child. Variants of these four items, originally derived from the Parenting Stress Index (PSI) (Abidin, 1990) have been used in several national level surveys to capture levels of parenting aggravation, including the National Survey of America's Families (NSAF) and the US Department of Health and Human Services' (DHHS) National Survey of Children's Health (NSCH). We reverse coded the responses, so that higher values indicate a higher extent to which parents felt that each statement was true. In our analytic sample, the reliabilities (based on an ordinal reliability measure given that each item of the scale used Likert responses (Gadermann, Guhn, & Zumbo, 2012; Zumbo, Gadermann, & Zeisser, 2007)), were .71 for the spring of kindergarten and .72 for the first grade.

Consistent with prior research using the parenting aggravation scale (Bronte-Tinkew, Horowitz, & Carrano, 2010; Yu & Singh, 2012), scores on each item were summed to create an overall count score which ranged from 0 to 12. As an alternative measure, we also used factor analysis to create a single continuous factor score. A Kaiser test revealed one singular factor, with eigenvalues of 1.47 (spring of kindergarten) and 1.57 (spring of first grade), that best summarized the items.

Main Predictor: Adult Food Insecurity Status. Our main predictor, adult food insecurity status, was based on the first 10 items of the US Department of Agriculture's (USDA) Household Food Security Survey Module (HFSSM), which included 7 items that explicitly pertained to an adult in the household. The HFSSM was administered to parents twice, once when their child was in the spring of kindergarten, and a year later when their child was in the spring of first grade. The HFSSM is retrospective and asked parents to recall their experiences in the previous 12 months. We created a dichotomous variable based on an adult's raw score on the HFSSM. Based on cutoffs established by the USDA, adults were classified with raw scores of 0

to 2 on the HFSSM as food secure (coded as 0), while adults with scores between 3 to 10 were classified as food insecure (coded as 1). Internal consistency reliabilities were high: $\alpha = .89$ for the spring of kindergarten and $\alpha = .87$ for the spring of first grade.

Control Variables. We included several time-varying controls related to children and their parents. These controls were measured in both the spring of kindergarten and first grade. Our selection of controls was motivated by prior theoretical and empirical literature, especially studies that have leveraged prior versions of the ECLS-K dataset to examine food insecurity, including Howard (2011) and Jyoti et al. (2005).

We included parent reported measures of children's impulsive/overactive behaviors and social interactions based on the Social Skills Rating System (SSRS). Impulsive/overactive behaviors was based on the mean of two items and social interaction was based on the mean of three items of the SSRS. We also included teacher reported measures of children's externalizing (mean of five items) and internalizing behaviors (mean of four items) on the SRSS. Both of these teacher-reported measures had high item reliabilities in both spring of kindergarten and first grade (all greater than .76). We also used indicator variables capturing a parent's report of whether their child had a disability that was diagnosed by a professional (has a disability = 1; 0 otherwise) as well as the child's health status (excellent, very good, or good = 0; fair or poor = 1).

Time varying parental and household characteristics included indicator variables for a parent's marital status (married or in a civil union/domestic partnership = 1, or not [e.g., separated, divorced or widowed] = 0), employment (employed [= 1] or not [= 0]) and whether the family received food stamps in the last 12 months (= 1) or not (= 0). We also included the number of siblings in a child's household and the household's socioeconomic status (SES). SES

was a National Center for Educational Statistics (NCES)-constructed continuous index consisting of a composite of parents' education level, their occupational prestige and income. We also included access to medical care, a count variable, ranging from 0 to 3, that we created by summing three indicator variables: whether a child visited the doctor and/or dentist in the past year or not; and whether the child had health insurance. Finally, we controlled for parental involvement in school as measured by whether the parent attended a parent teacher association (PTA) meeting or volunteered at the child's school since the beginning of the school year (= 1) or not (= 0).

Analytic Strategy. To estimate how adult food insecurity related to parenting aggravation, we used first-difference regression (Allison, 2009; Wooldridge, 2003). The main advantage in using first-difference regression was that each adult served as their own control, thereby reducing bias due to factors—both observed and unobserved— potentially confounded with food insecurity that remained constant within each adult across time. More formally, we fitted the following first-differenced regression model:

$$\Delta \mathrm{Y}_i = \alpha_0 + \beta_1 \Delta \text{Adult Food Insecurity Status}_i + \gamma \Delta X_i + \Delta \mathrm{u}_i \qquad (1)$$

where $\Delta \mathrm{Y}_i$ represents the change in our parenting aggravation measure for adult *i* while $\Delta \text{Adult Food Insecurity Status}_i$ is the change in an adult's food insecurity status (where status at each wave is coded as adult food insecure = 1; adult food secure = 0). $\Delta \mathrm{u}$ is the idiosyncratic error representing time-varying unobserved determinants of $\Delta \mathrm{Y}_i$. ΔX_i, represents time-varying covariates potentially confounded with changes in adults' own food insecurity status. In this model, β_1, the first-differenced estimator, captures the effect of adult food insecurity on parenting aggravation.

All models were fitted to our 30 imputed datasets using Stata 15.1 (StataCorp, 2017) and the results were pooled together. We included survey weights to account for non-response and unequal probability of selection. Per National Center for Education Statistics (NCES) guidelines for analyzing the ECLS-K data, standard errors were estimated via Taylor linearization. We adopted a conventional level of significance ($\alpha = .05$) with which to test the null hypothesis that the estimate of β_1 did not significantly differ from zero.

Robustness Checks. We conducted two robustness checks. First, we fitted a series models using the parenting aggravation factor scores rather than the summed scores. Second, given that parents were grouped into geographical areas by zip code, we assessed the sensitivity of our results to unobserved time-constant effects of living in the same zip code area; to do so, we augmented model (1) by incorporating a set of indicators for each zip code. In these models, we also accounted for the non-independence of adults within neighborhood by clustering our standard errors by zip code.

Research Question 2: Sample, Measures and Analytic Strategy

Analytic Sample Using Coarsened Exact Matching (CEM). To reduce bias due to observed differences between food insecure and secure groups, prior to fitting our mediation models, we used a novel matching approach known as coarsened exact matching (CEM) (Blackwell, King, & Porro, 2009; Iacus et al., 2011) to match individuals on a set of baseline characteristics to obtain our analytic sample. Intuitively, CEM takes a set of observed baseline characteristics (e.g., income) of adults before they reported their food insecurity status, creates discrete (i.e., "coarsened") groups for each characteristic (e.g., in the bottom income quartile) and then finds exact matches between food insecure and secure adults who have the same pattern in these coarsened characteristics. Only observations sharing the same patterns in the coarsened

characteristics—and, thus more similar in observable ways—were retained for the analysis. In contrast to other matching techniques, CEM achieves more optimal balance on observed characteristics between treated and non-treated units (in our case, between food secure and insecure adults) (Iacus et al., 2011).

To obtain our matched sample, we first identified adults in the ECLS-K dataset who were reported to be food insecure (n = 1,160) and food secure (n = 11,160) in the 12 month window prior to spring that their children were in first grade. Using this sample (n = 12,320 total), we matched on eight baseline characteristics documented in spring of kindergarten, including demographics and key predictors of food insecurity: on food stamps in the past 12 months; number of places a child lived four months or more since birth, access to medical care, parental income, parental education, employment status, marital status, number of siblings and racial and ethnic background. Both prior theoretical and empirical work on determinants of food insecurity guided our selection of these characteristics (e.g. Rose, [1999]), as well as the broader literature on material hardship (Gershoff et al., 2007). There were 6,823 distinct patterns (i.e., strata) in these characteristics and matches within 289 of those strata. Across the 289 strata with matches in them, 1,600 individuals were food secure, while 470 were food insecure. This yielded a total analytic sample of 2,070 individuals. Through CEM, we were able to achieve balance between the insecure and secure groups on our selected baseline characteristics. For each variable, a measure of imbalance, known as the multivariate *L1* distance (Blackwell et al., 2009), was less than 0 indicating a lower level of imbalance relative to imbalance in the unmatched data (*L1* statistic for unmatched data=.06).

Measures.

Outcome: Executive Functioning. To measure children's executive functioning, we used scale scores derived from children's teachers' reported scores on the 12-item Children's Behavior Questionnaire (CBQ) (Putnam & Rothbart, 2006). We used teachers' responses to the CBQ in the spring of first grade. Each item on the CBQ asked teachers to rate, on a 7-point scale how true certain statements were about how a child may have reacted to a particular set of situations. Six of the 12 items on the CBQ captured children's attentional focus, defined as their ability to "focus attention on cues in the environment that are relevant to the task in hand" (Tourangeau et al., 2015) while the remaining six items captured inhibitory control, defined as their ability to "resist a strong inclination to do one thing and instead to do what is most appropriate" (Tourangeau et al., 2012). Higher scale scores for each construct indicated that the child exhibited more of each behavior. The six attentional focus items had reliabilities of .87 and .83 in the spring of kindergarten and first grade respectively, while the six inhibitory control items had reliabilities of .87 and .86.

Outcome: Internalizing and Externalizing Problem Behaviors. Both internalizing and externalizing problem behaviors were based on teachers' responses to the Social Skills Rating System (SSRS) (Gresham & Elliott, 1990) in the spring of first grade. A child's internalizing problem behavior was based on a composite of four items on the SSRS (e.g., appears lonely), while externalizing problem behavior was based on a composite of five items (e.g., gets angry easily). Each measure ranged from 1 to 4, with higher scores indicating that the child exhibited the behavior represented by the scale more often. The externalizing behavior items had reliabilities of .89 and .88 in the spring of kindergarten and first grade respectively, while the internalizing behavior items had reliabilities of .78 and .76.

Main independent variable. We used the measure of adult food insecurity status as previously described.

Mediator variable. Our main mediator was parenting aggravation captured in the spring of first grade which we previously described. We used the summed version (i.e., scores ranging from 0 to 12) of the parenting aggravation scores.

Analytic Strategy: Mediation Analysis. To determine whether parenting aggravation (reported in the spring of first grade) mediated the relationship between adult food insecurity (the 12-month window prior to spring of first grade) and children's outcomes (spring of first grade), we used mediation analysis (MacKinnon, 2008; MacKinnon, Fairchild, & Fritz, 2007). Figure 2 displays the hypothesized mediational relationship between (1) adult food insecurity; (2) parenting aggravation; and (3) children's outcomes. In this Figure, path a represents the direct effect of adult food insecurity on parenting aggravation; path b is the direct effect of aggravation on children's outcomes; while path c' is the direct effect of adult food insecurity on children's outcome controlling for parenting aggravation. The indirect effect—the effect of food insecurity on outcomes that is mediated by aggravation—is estimated as $a \times b$. We included several controls in our models to account for any potential confounding along each pathway. For instance, in modeling the effect of adult food insecurity on aggravation (path a), we controlled for parental socioeconomic status. Also, in modeling the link between aggravation and children's behavioral outcomes (path b), we controlled for a child's gender and disability status. We describe our selected controls in Supplemental Table A1 in the Appendix.

As with any mediation analysis, there are limitations to what we can infer from the results of mediation modeling and therefore, we used this analytic technique as a descriptive tool to examine associations rather than establish causal relationships. While matching reduced bias and

including controls accounted for some extraneous influences, we could not fully account for other omitted influences and mediators, especially factors that remained unobserved.

We fitted our mediation models in Stata 15.1 using commands for structural equation modeling (SEM) to simultaneously fit the mediation model. We incorporated survey weights in our analyses to account for nonresponse and estimated our standard errors using Taylor linearization, the prescribed method for estimating standard errors using the ECLS-K data. To handle missing data, we fitted our models using maximum likelihood for missing values (MLMV), which enabled us to include observations with partially missing data.

<<insert Figure 2 here>>

<<insert Supplemental Table A1 here>>

Results

Research Question 1: How does food insecurity, as experienced by adults, relate to their own levels of parenting aggravation?

Descriptive Statistics. Table 1 provides weighted descriptive statistics for the analytic sample, disaggregated by wave. The final two columns show the estimated mean difference between waves and the associated *p* value for a *t* test that the difference in means between waves significantly differed from zero.

For the main outcome, parenting aggravation, the average summed scores in the spring of kindergarten was significantly higher relative to spring of first grade (mean difference = 1.10; $p < .001$). The main predictor, adult food insecurity was prevalent among 9.4% of the parents in the 12-month window prior to the spring of kindergarten and 8.2% for spring of first grade, a 1.2 percentage point difference which was statistically significant ($p < .05$).

Regarding other select family-level characteristics, a majority of parents reported that they were married or in a civil union or domestic partnership (approximately 72% in each wave) and were employed (64% and 68% at each wave, respectively). Roughly a quarter of parents (23.8% and 25%) were on food stamps. Finally, by racial and ethnic backgrounds, parents' children in the sample were 57% White non-Hispanic, 22% Hispanic, 12% Black non-Hispanic, and 4% Asian non-Hispanic. Approximately 86% of the children spoke English as their first language.

<<Insert Table 1 here>>

Main Results. Our adjusted first-differences results, reported in column 1 of Table 2, indicate that adult food insecurity was related to heighted parenting aggravation scores by 0.376 ($p < .01$), an effect size (based on Cohen's *d* [Cohen, 1988]) of approximately 0.16 of a standard deviation (SD). Given that our first differences estimation treats adults who transition into food insecurity the same as those who transition out of food insecurity, we fitted two subsequent models that separately included only adults who experience either transitions into or out of food insecurity. As shown in column 2 of Table 2, adults who were previously food secure, but later became food insecure experience heighted parenting aggravation scores by 0.525 ($p < .01$), an effect size of 0.23. On the other hand, those who transitioned out of food insecurity (they became food secure) also experience heighted aggravation; however, we cannot rule out zero effects.

<<Insert Table 2 here>>

Robustness Checks. Supplemental Table A2 in the Appendix presents our findings using alternative model specifications. Results from both alternative specifications remain highly consistent with our main first-difference model results.

<<Insert Supplemental Table A2 here>>

Research Question 2: Does parenting aggravation mediate the relationship between adult food insecurity and children's outcomes?

Descriptive statistics and correlations. Table 3 displays descriptive statistics and correlations and for the matched sample (n = 2,070) of food secure (n = 1,600) and food insecure (n = 470) adults. As expected, given the results of our fixed effects analyses, adult food insecurity is significantly and positively correlated with parenting aggravation (.189; $p < .001$). In addition, aggravation is negatively correlated with executive functioning (attentional focus [-.122; $p < .001$] and inhibitory control [-.172; $p < .001$]) and positively correlated with both externalizing and internalizing behaviors (.143; $p < .001$ and .059; $p < .05$, respectively). Finally, adult food insecurity is not significantly correlated with any of the child outcomes ($p > .05$ for each correlation between adult food insecurity and each behavioral outcome).

<<Insert Table 3 here>>

Main Results. In Table 4 we report our mediation analysis results. The first row reports the standardized and unstandardized estimates for the relationship between adult food insecurity and the mediator, parenting aggravation. Since this relationship is the same for each mediation model, we present this only once. The subsequent rows present each of the paths (b) and (c') for each of the four outcomes. Since the survey estimation command we used to fit our mediation models in Stata did not provide goodness-of-fit statistics (e.g., Root Mean Squared Error of Approximation [RMSEA]), we refitted our models without the survey commands to gauge model fit. These model fit statistics (RMSEA; comparative fit index [CFI]; and Tucker-Lewis index [TLI]) are reported in Table 5. Based on these fit statistics, each unweighted model fitted the data well given that each RMSEA was less than the .06 threshold for an acceptable fitting

model. Further, the CFI and TLI values for each model were greater than .95, indicating a good model fit.

<<Insert Table 4 here>>

<<Insert Table 5 here>>

Our findings reported in Table 4 for each mediation model corroborates what we previously established in answering our first research question: path a is positive and significant (standardized effect = 0.172; $p < .001$) which demonstrates that adult food insecurity led to heighted parenting aggravation. Importantly, we find consistent evidence that food insecurity as experienced by adults does not directly relate to children's outcomes; rather, it indirectly relates to children's outcomes through the mechanism of parenting aggravation. We believe that this finding represents an instance of an indirect-only mediation model (Zhao et al., 2010) in which mediation can still occur even though the direct effect is non-significant (Rucker et al., 2011). In particular, for our models predicting a child's executive functioning, the indirect effect of adult food insecurity on children's attentional focus and inhibitory control that is mediated by parenting aggravation is -0.022 ($p < .05$) and -0.033 ($p < .001$) respectively. In other words, adult food insecurity is indirectly associated with lowered executive functioning via heightened parenting aggravation. Similarly, adult food insecurity relates to higher externalizing behaviors through heightened parenting aggravation (0.033; $p < .001$). Children's internalizing behaviors were neither directly nor indirectly associated with adult food insecurity. In sum, based on these mediation modeling results, we conclude that adult food insecurity indirectly linked to children's behavioral outcomes—specifically, their attentional focus, inhibitory control and externalizing behaviors—via parenting aggravation.

Discussion

Our findings establish that for parents who were raising young children in their early elementary years in the aftermath of the Great Recession of 2007-9, adult food insecurity had negative consequences on their parenting. In particular, parents who were previously food secure, but later became food insecure experienced heightened levels of parenting aggravation. This finding is consistent with the Family Stress Model (Conger et al., 2000) and supports our hypothesis that parental food insecurity would lead to higher parenting aggravation. Further, our findings are unique in that they more precisely pinpoint the source of parents' distress in the wake of food insecurity to their own experience of food insecurity. We also show that parenting aggravation mediated the relationship between parents' food insecurity and their children's behavioral outcomes. While prior research has shown a mediational effect of parenting stress bridging food insecurity to children's internalizing and externalizing behaviors (Huang et al., 2010; Slack & Yoo, 2005), we showed that the mediational role of parenting aggravation also extends to children's executive functioning, including lowered attentional focus and inhibitory control.

In contrast to our hypothesis of a partial mediational effect, however, we did not find a direct effect of food insecurity on children's behavioral outcomes. On the contrary, our findings are more consistent with empirical evidence that the incidence of household food insecurity may not directly influence children's cognitive and/or behavioral outcomes, especially in the early elementary years (Alaimo et al., 2001; Howard, 2011; Jyoti et al., 2005; Winicki & Jemison, 2003). For instance, Howard (2011) found that food insecurity at the household level was unrelated to externalizing behavior scores for third graders. Furthermore, first graders from households transitioning into food insecurity versus those from food secure homes did not have lower internalizing behavior (Kimbro & Denney, 2015), a finding consistent with ours. In light

of our results, it is plausible to suggest that these studies found no direct effect because food insecurity's influence is fully transmitted through parents themselves via their parenting behaviors.

There are several limitations to note. While we accounted for a set of time-varying observables to control for changes contemporaneous with changes in food insecurity status, our first-difference estimation strategy did not allow us to control for time-varying unobserved factors, which could have introduced bias into our estimates. However, given the relatively short time period of our study—a year between spring of kindergarten and first grade—unobserved factors were less likely to change in ways to significantly affect our estimates. Also, we were unable to account for any measurement error from adults misreporting their incidence of food insecurity. Finally, as addressed earlier, in our mediation analyses, we acknowledge that there are a multitude of other mediators and pathways, especially those that remained unobserved and thus untestable in our mediation models.

Despite these limitations, our study does demonstrate that adult food insecurity relates to parenting aggravation and that aggravation, onset by food insecurity, serves as a mechanism that transmits food insecurity's influence on children's behavior problems and executive functioning. Future research on pathways between food insecurity, parenting attitudes and child development should further explore additional mechanisms that may influence children in their early elementary years. Also, the effects we detected may not remain stable over the long run; thus, studies that leverage longer term data as children progress through their elementary years into adolescence would provide a more robust view of food insecurity's effects over children's developmental spans.

In closing, our study underscores the importance of addressing food insecurity from a broader family systems perspective. Beyond the nutritional dynamics of food insecurity, food insecurity is a complex family microsystem-level phenomenon influencing behaviors of parents and their children; further, as we have shown, it is a phenomenon that influences parental well-being which in turn can influence parent-child interactions, core drivers of children's development. Given our findings, we suggest strengthening parenting supports to reduce parenting stress onset by food insecurity especially for vulnerable parent groups such as single mothers from low-income backgrounds, a group who disproportionately bears the brunt of food insecurity. Supporting food insecure parents, not just by stabilizing their access to food, but with broader psychosocial support may ultimately have benefits for both parents and their children.

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Figure 1

Family Stress Model (Masarik & Conger, 2017)

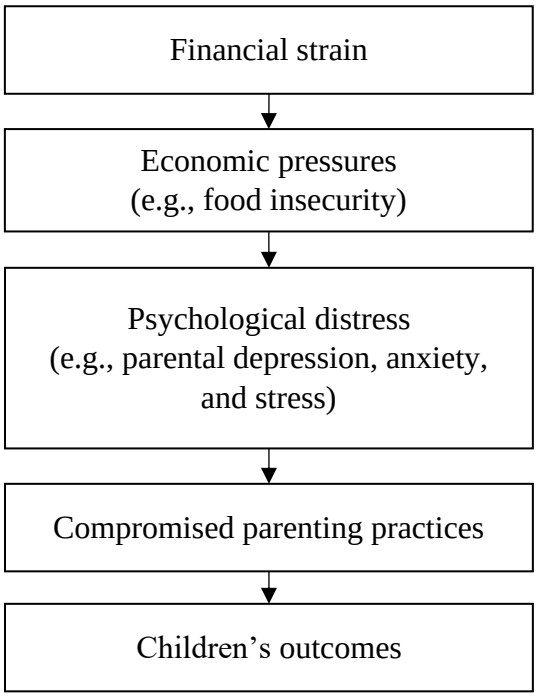

Figure 2. Hypothesized Single Mediator Model. Mediational Relationship Between Adult Food Insecurity, Parental Aggravation and Child Behaviors.

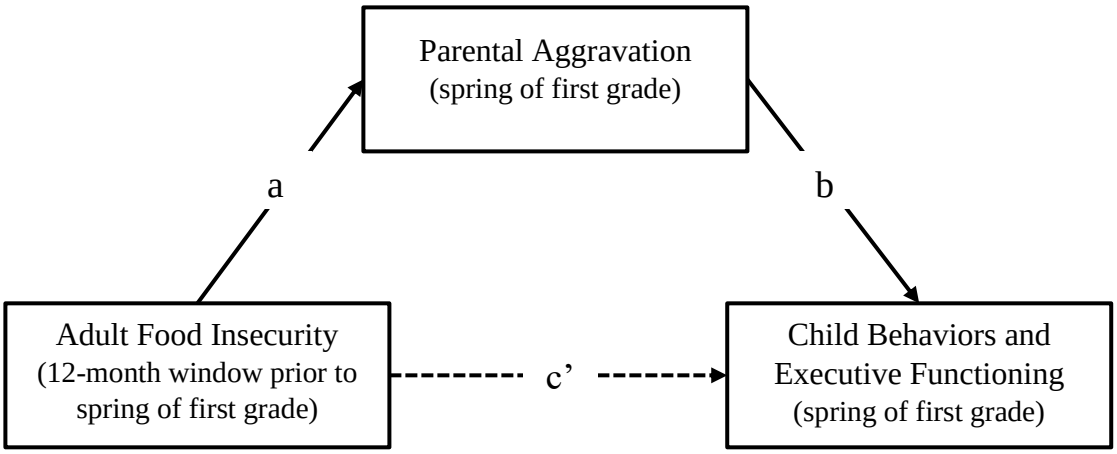

Table 1. Univariate Weighted Descriptive Statistics

	Spring of Kindergarten		Spring of First Grade		Change from Spring of Kindergarten to Spring of First Grade		
	Mean or Proportion	*SD*	Mean or Proportion	*SD*	Mean or Proportion	*SD*	*p*
Outcome							
Parental aggravation	3.723	(2.476)	2.622	(2.113)	-1.101	(2.263)	.000
Food insecurity predictor							
Adult is food insecure	0.094	(0.292)	0.082	(0.274)	-0.012	(0.298)	.017
Child behaviors and characteristics							
Impulsive/overactive	1.897	(0.670)	1.875	(0.646)	-0.021	(0.590)	.035
Social interaction	3.469	(0.520)	3.475	(0.526)	0.006	(0.502)	.469
Externalizing	1.594	(0.608)	1.689	(0.580)	0.095	(0.542)	.000
Internalizing	1.481	(0.473)	1.532	(0.494)	0.051	(0.584)	.000
Child has a disability	0.210	(0.407)	0.146	(0.354)	-0.063	(0.395)	.000
Child has fair or poor health	0.019	(0.135)	0.018	(0.134)	-0.000	(0.159)	.878
Parental and household characteristics							
Married	0.722	(0.448)	0.721	(0.448)	-0.001	(0.230)	.797
Number of siblings	1.523	(1.099)	1.560	(1.112)	0.037	(0.333)	.000
Socioeconomic status	-0.008	(0.771)	-0.032	(0.772)	-0.025	(0.216)	.000
Access to medical care	2.775	(0.504)	2.748	(0.538)	-0.027	(0.595)	.010
Employed	0.641	(0.480)	0.682	(0.466)	0.041	(0.381)	.000
On food stamps in the last 12 months	0.238	(0.426)	0.250	(0.433)	0.013	(0.302)	.019
Parent involved in school	3.032	(0.747)	2.984	(0.752)	-0.048	(0.730)	.000
Time invariant child characteristics							
Male	0.509	(0.500)					
White non-Hispanic	0.566	(0.496)					
Black non-Hispanic	0.120	(0.325)					
Hispanic	0.222	(0.415)					
Asian, non-Hispanic	0.035	(0.184)					
Other (Native American, Pacific Islander, Multi-racial)	0.058	(0.233)					
Home language is English	0.863	(0.344)					
Observations (unweighted)	5,770		5,770		5,770		

Table 2. First-Difference Regression Results for the Effect of Adult Food Insecurity on Parental Aggravation.

	(1) Transitions into and out of adult food insecurity combined		(2) Transitions into adult food insecurity		(3) Transitions out of adult food insecurity	
Changes in adult food insecurity status	0.376**	(0.120)	0.525**	(0.183)	0.258	(0.159)
Changes in child behaviors and characteristics						
Impulsive/overactive	0.334***	(0.063)	0.333***	(0.063)	0.344***	(0.065)
Social interaction	-0.191*	(0.074)	-0.201*	(0.078)	-0.180*	(0.072)
Externalizing	-0.092	(0.058)	-0.074	(0.059)	-0.105	(0.060)
Internalizing	-0.033	(0.063)	-0.016	(0.065)	-0.026	(0.067)
Child has a disability	0.035	(0.077)	0.030	(0.082)	0.050	(0.082)
Child has fair or poor health	0.275	(0.258)	0.280	(0.286)	0.326	(0.284)
Changes in parental and household characteristics						
Married	0.054	(0.167)	0.039	(0.173)	0.023	(0.163)
Number of siblings	0.064	(0.133)	0.043	(0.143)	0.064	(0.131)
Socioeconomic status	0.099	(0.138)	0.167	(0.141)	0.087	(0.140)
Access to medical care	-0.004	(0.041)	-0.004	(0.043)	-0.002	(0.044)
Employed	0.041	(0.096)	0.029	(0.103)	0.037	(0.099)
On food stamps in the last 12 months	0.161	(0.128)	0.156	(0.137)	0.163	(0.133)
Parent involved in school	-0.004	(0.039)	-0.007	(0.040)	-0.001	(0.042)
Constant	-1.109***	(0.034)	-1.116***	(0.035)	-1.123***	(0.034)
Observations (unweighted)	7820		7820		7820	

Linearized standard errors in parentheses. Models fit across 30 imputed datasets where missing data was imputed using multiple imputed chained equations (MICE). Survey weights included to account for differential nonresponse.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 3. Sample Descriptive Statistics and Correlations.

	Mean	SD	1	2	3	4	5	6
Independent variable								
1 Adult food insecurity	0.211	(0.408)	-	.189***	-.005	.008	-.031	-.003
Mediator								
2 Parental aggravation (factor scores)	0.012	(0.800)		-	-.122***	-.172***	.143***	.059*
Child outcomes								
3 Attentional focus	4.752	(1.290)			-	.777***	-.559***	-.726***
4 Inhibitory control	5.009	(1.333)				-	-.314***	-.274***
5 Externalizing behavior	1.740	(0.649)					-	.308***
6 Internalizing behavior	1.561	(0.520)						-

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Matched sample using Coarsened Exact Matching (CEM).

Table 4. Results of Models Estimating How Parenting Aggravation Mediates Adult Food Insecurity's Relationship to Children's Behavioral Outcomes.

	Path	Direct			Indirect (a × b)			Total		
		β	B	*SE*	*β*	B	*SE*	*β*	B	*SE*
a	Adult food insecurity → Parenting aggravation	0.172***	0.853***	(0.198)	-	-	-	0.172***	0.853***	(0.198)
b	Parenting aggravation → Attentional focus	-0.128***	-0.072***	(0.023)	-	-	-	-0.128***	-0.072***	(0.023)
c'	Adult food insecurity → Attentional focus	0.032	0.090	(0.121)	-0.022*	-0.062*	(0.026)	0.010	0.028	(0.125)
b	Parenting aggravation → Inhibitory control	-0.190***	-0.108***	(0.021)	-	-	-	-0.190***	-0.108***	(0.021)
c'	Adult food insecurity → Inhibitory control	0.056	0.160	(0.123)	-0.033***	-0.093***	(0.027)	0.024	0.068	(0.126)
b	Parenting aggravation → Externalizing behavior	0.194***	0.050***	(0.010)	-	-	-	0.194***	0.050***	(0.010)
c'	Adult food insecurity → Externalizing behavior	-0.002	-0.003	(0.047)	0.033***	0.043***	(0.012)	0.031	0.040	(0.050)
b	Parenting aggravation → Internalizing behavior	0.044	0.009	(0.011)	-	-	-	0.044	0.009	(0.011)
c'	Adult food insecurity → Internalizing behavior	-0.021	-0.022	(0.044)	0.007	0.008	(0.010)	-0.013	-0.014	(0.034)
	Observations	2070								

Standardized estimates (*β*) and unstandardized estimates (B). Taylor linearized standard errors (SEs) in parentheses for the unstandardized estimates.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$

Table 5. Model Fit Indices for Models Estimating How Parenting Aggravation Mediates Adult Food Insecurity's Relationship to Children's Behavioral Outcomes.

Mediation Model	χ^2 (*df*)	*p*	*RMSEA*	*CFI*	*TFI*
Adult food insecurity → Parenting aggravation→ Attentional focus	247.087 (13)	.000	.006	.999	. 996
Adult food insecurity → Parenting aggravation→ Inhibitory control	280.733 (13)	.000	.022	.993	.951
Adult food insecurity → Parenting aggravation→ Externalizing behavior	205.189 (13)	.000	.022	.993	.952
Adult food insecurity → Parenting aggravation→ Internalizing behavior	94.206 (13)	.000	.000	1.00	1.00

RMSEA=root mean squared error of approximation; *CFI*=comparative fit index; *TFI*=Tucker-Lewis index. Reported goodness-of-fit statistics (*RMSEA, CFI* and *TFI*) from models without survey commands.

Supplemental Table A1. Description of Control Variables Included in Mediation Models

Controls for model predicting the mediator variable, parental aggravation (spring of first grade)	
Socioeconomic status (SES) (spring of first grade)	A National Center for Educational Statistics (NCES)-constructed continuous index based on a composite of parents' education level, their occupational prestige and income.
Parental depression (fall of first grade)	Based on a 12-item version of the Center for Epidemiologic Studies Depression Scale (CES-D) (Radloff, 1977) that was administered to parents in the spring kindergarten wave. The items captured different feelings and experiences parents had (e.g., fear, anger, depression) during the past week on a four-point Likert scale. Internal consistency reliability was high (α =.87) and we used factor analysis to create a continuous factor score.
Disability status (spring of first grade)	A categorical variable based on parental report about whether the child had a disability that was diagnosed by a professional (has a disability=1; 0 otherwise).
Gender (fall of kindergarten)	Whether the child was a girl (=1) or boy (=0).
Controls for model predicting children's outcomes (spring of first grade)	
Parent involved in school (spring of first grade)	A parent-reported variable indicating whether the parent attended a parent teacher association (PTA) meeting or volunteered at the child's school since the beginning of the school year (=1) or not (=0).
Socioeconomic status (SES) (spring of first grade)	A National Center for Educational Statistics (NCES)-constructed continuous index based on a composite of parents' education level, their occupational prestige and income.
Disability status (spring of first grade)	A categorical variable based on parental report about whether the child had a disability that was diagnosed by a professional (has a disability=1; 0 otherwise).
Gender (fall of kindergarten)	Whether the child was a girl (=1) or boy (=0).

Supplemental Table A2

Robustness Checks	(1) Transitions into and out of adult food insecurity combined		(2) Transitioned into adult food insecurity		(3) Transitioned out of adult food insecurity	
Main estimates from Table 3	0.376**	(0.120)	0.525**	(0.183)	0.258	(0.159)
A: Models with aggravation factor scores	0.180**	(0.052)	0.265**	(0.078)	0.110	(0.067)
B: Models with neighborhood (zip code) fixed effects	0.384**	(0.131)	0.491*	(0.215)	0.307	(0.180)

Note. Linearized standard errors in parentheses. Models fit across 30 imputed datasets where missing data was imputed using multiple imputed chained equations (MICE). Survey weights included to account for differential nonresponse. Models with neighborhood fixed effects displayed in the last row have standard errors that are clustered by zip code.
* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$